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HEMPHILLIA DROMEDARIUS, A NEW ARIONID SLUG FROM WASHINGTON[1]

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During a survey of the terrestrial Gastropoda of the Olympic Peninsula, Washington, several specimens of the peculiar arionid slug genus *Hemphillia* were secured, including an apparently new species. The genus exhibits a somewhat circumscribed distribution in Idaho and Alberta, Canada (*H. camelus* Pilsbry and Vanatta) (LaRocque, 1953; Pilsbry and Vanatta, 1898; Smith, 1943), Montana (*H. danielsi* Vanatta), Oregon, Washington, and British Columbia (Henderson, 1929; Pilsbry, 1948). Pilsbry's (1917) *H. malonei*, described from a single formalinized specimen collected near Mt. Hood, Oregon, remains problematic.

Hemphillia and *Binneya* comprise the subfamily Binneyinae, a complex of slug species morphologically intermediate between normally coiled, testaceous snails and shelless slugs in possessing an exposed shell (partially coiled in *Binneya*) and short visceral cavity confined to a dorsal hump or pouch-like arrangement of the body (Pilsbry, 1948; Webb, 1961). In *Hemphillia,* the platelike shell is only slightly attached to the mantle at its edges and, contrary to Pilsbry's (1948) observation that "in life the shell is usually almost or quite covered," usually exposed, even at rest. The foot is undivided.

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Hemphillia burringtoni Pilsbry Fig. 1b, d

Pilsbry (1948: pp 741-742, Fig. 397a, b, c, d)

In elevating this form to full species' rank, I was guided by the consistent differences of genitalia and external pigmentation patterns. *Hemphillia glandulosa* Bland and Binney, in which Pilsbry (1948) placed *H. burringtoni* as a subspecies, exhibits a papillose mantle in contrast to the smooth one of *H. burringtoni*; a rugose stimulator in contrast to a smooth one; and a considerably different external color pattern. In *H. burringtoni*, the sides of the foot (Fig. 1d) bear spaced black lines which terminate in round black spots (between the granules); this pattern is lacking in *H. glandulosa*. Holotype and paratypes, Academy of Natural Sciences of Philadelphia (ANSP 182093); type locality: Rialto Beach, Clallam County, Washington.

Distribution: Hemphillia glandulosa occupies mainland Washington west of the Cascades and adjacent British Columbia westward to the Olympic and Grey Wolf mountains and southward to northern Oregon. *Hemphillia burringtoni* is restricted to the Olympic Peninsula of Washington State.

Collecting sites for *Hemphillia burringtoni:* 1, S17, R11W, T23N, Macafee Quadrangle, 545 feet mean sea level (MSL), Grays Harbor County, Washington, 5 July 1969; 1, Bush Pacific State Park, near Bay Center, Pacific County, Washington, 5 August 1969; 1, S4, R9W, T27N, rain forest of Mt. Tom Quadrangle, 1,000 feet MSL, Clallam County, Washington, 11 July 1969; 1, three miles up trail to Enchanted Valley from Dosewallips Campground, Olympic National Park, Mt. Christie Quadrangle, 780 feet MSL, Jefferson County, Washington, 3 July, 1969; 2, Deer Park Road, 10.3 miles after leaving U.S. 101, Mt. Angeles Quadrangle, 2,460 feet MSL, Clallam County, Washington, 7 July 1969; 1, Cox Valley, R5W, T29N, Mt. Angeles Quadrangle, 3,435 feet MSL, Clallam County, Washington, 13 July 1969; and 1, North Point Lookout, R2W, T27N, Mt. Walker, 2,625 feet MSL, Mason County, Washington, 26 June 1969.

The following descriptions were secured from living specimens, but the measurements are from relaxed, alcoholized individuals.

The jaw is dark-brown in most individuals and bears 10 central striations, the lateral margins being non-striate. The body is strongly laterally compressed, almost keel-like, behind the posterior

tip of the mantle, and likewise deeply incised (from a lateral view: Fig. 1d) to bear the visceral pouch. Posteriorly, the moderately developed hornlike protrubrance above the caudal mucus gland is bluntly rounded behind, but is rather triangular in lateral view. Colorwise, the posterolateral margins of the mantle are mostly pigmentless, except for a distinct band which sends a series of very thin lines toward the shell to produce a reticulum. The anterior and dorsal portions of the mantle are much-speckled and blotched with dark grey and black, and the head and tentacles are black. The sole is pale yellowish-white and immaculate, whereas the foot immediately above the pedal furrow, which is broken up into 17 to 23 cell-like granules, bears a single row of round, very black spots that are contacted by thin, oblique lines. The sides of the body below the dorsal hump are sooty gray to yellowish white, diagonally marked by 7 to 9 rather broad, dark gray bands. The shell tapers sharply caudad, the anterior quarter being yellow and the posterior three quarters greenish-gray; the shell is farther subdivided (in appearance) by a dense black accumulation of pigment beneath its middle. The secretory groove, located at the posterior end of the mantle, is directed nearly straight downward; in life this groove stands open most of the time. The pneumostome is located just posterior to the middle of, or as far back as the posterior one-third, of the mantle. There are a few granules on the mantle caudal to the shell. Proportional measurements: total length 13.07 mm (8.0-19.3); width of foot/total length = 0.20 (0.15-0.24) (in small specimens, this percentage is larger); posterior end of mantle to pneumostome/total length = 0.37 (0.35-0.40); width of shell/length of shell = 0.68 (2.0-2.8/2.2-4.5 mm); width visceral pouch/length visceral pouch = 0.51 (2.5-5.0 mm/5.0-10.4 mm); width back behind pouch/height behind pouch = 0.39 (0.8-1.4 mm/1.8-3.5 mm); length body behind mantle/total length = 0.33 (1.5-9.0 mm/8.0-19.3 mm).

Key to species of Hemphillia

1 a. Body behind pouch at first depressed to receive the visceral mass then forming a high, compressed keel 2
b. Body behind pouch neither depressed nor forming a compressed keel 3
2 a. Visceral pouch bearing numerous papillae; penial stimulator rugose within ..... *Hemphillia glandulosa*

b. Visceral pouch nearly smooth; penial stimulator smooth within ..... *Hemphillia burringtoni*

3 a. Penis narrow, with an accessory sac; color yellowish-gray to whitish with black markings ..... *Hemphillia danielsi*

b. Penis broad, lacking an accessory sac; color ashy-gray, bluish-black to black 4

4 a. Tail with a conspicuous horn-like protrubrance above meeting of the pedal grooves ..... *Hemphillia dromedarius*

b. Tail lacking a horn-like protrubrance above meeting of pedal grooves ..... *Hemphillia camelus*

Hemphillia dromedarius, *new species* Fig. 1a, c

Description of holotype. The head is dark-gray, the tenacles somewhat lighter. A pair of shallow, pale yellowish white grooves occupy the head immediately behind the tentacles. The mantle, including the visceral pouch, is mottled gray, but much whiter on the sides. Below the visceral pouch, the sides of the body are white flecked with gray. Posterior to the pouch, the back is moderately narrowed and rounded rather than keeled, and dark gray on the midline, lighter below and tending to white flecked with gray along the sides. The sole and sides of the foot are pale yellowish, the cell-like granules above the pedal groove being delineated by gray, the gray streaks coalescing posteriorly to color the edge of the foot gray. The integument of the back is broken up into diagonal rows of low

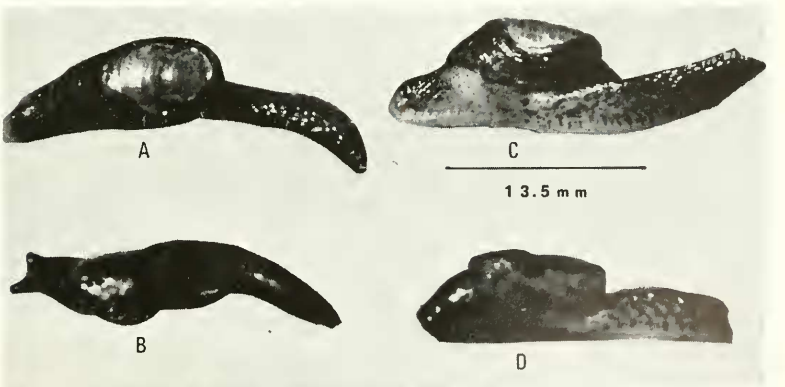

Fig. 1. A. Holotype, *Hemphillia dromedarius*, dorsal view. Staircase Falls, Olympic National Park, Washington. B. *Hemphillia burringtoni*, dorsal view. Mt. Christie Quadrangle, 3 miles up Enchanted Valley Trail from Dosewallips Camp, Olympic National Park, Washington. C. *Hemphillia dromedarius*, left lateral view of holotype. D. *Hemphillia burringtoni*, left lateral view.

ridges which emanate from the midline and extend dorsoventrad and posteriad. The pneumostome, on the right in the posterior one-half of the mantle, is surrounded by a narrow, white halo. The shell, located on the posterior one-half of the visceral pouch, is pale yellowish-horn in color, is transparent, and is approximately twice as long as wide; its position causes the surrounding integument to be thrown into five concentric grooves and furrows. The external surface of the shell shows a series of fine growth ridges. From a point on the midline of the dorsal pouch, immediately behind the shell, a definite secretory groove extends posterioventrad slightly toward the left. A deep caudal mucus pit occurs near the posterior tip of the tail, and there is a definite horn-like process above it. A white groove extends to the tip of the tail from the pit. The brownish jaw possesses 20 plates, and the genital pore is located near the base of the right tentacle. Total length 29.8 mm; width of foot (4.0 mm) is 13% the length; the measurement from the posterior tip of the visceral pouch to the pneumostome (6.5 mm) comprises 22% of the length, and the length of the foot posterior to the visceral pouch (12.5 mm) 42% of the length. The visceral pouch, 7.0 mm/13.0 mm, is slightly more than twice as long as wide (54%). Width of the back behind the dorsal pouch (3.5 mm) is 70% of the depth of the back (5.0 mm.), and the width of the shell (5.5 mm) is 69% of the length (8.0 mm). Holotype: USNM 577690; type locality (28 June 1969): Staircase Rapids, Staircase Campground, Olympic National Park, Mt. Steel Quadrangle, Mason County, Washington; 645 feet MSL.

Specific epithet from that of the Arabian or one-humped camel, *Camelus dromedarius*.

Collecting localities for paratypes: 1, 3 miles up trail to Enchanted Valley from Dosewallips Campground, Olympic National Park, Mt. Christie Quadrangle, 780 feet MSL, Jefferson County, Washington, 3 July, 1969; Delaware Museum of Natural History (DMNH 43029); 2, slope between the junction of main road and Obstruction Point Road, Olympic National Park, 4,710 feet MSL, Mt. Angeles Quadrangle, Clallam County, Washington, 14 July 1969; 1, S32, T25N, R10W, Queets Campground, Olympic National Park, 284 feet MSL, Salmon River Quadrangle, Jefferson County, Washington, 8 July 1969; 1, R9W, T23W, extreme southeast corner of Kloochman Rock Quadrangle, 400 feet MSL, Jefferson County,

Washington, 2 July 1969, Field Museum of Natural History (FMNH 173022); 1, 5 miles above Flapjack Lakes trail head, Olympic National Park, Mt. Steel Quadrangle, 3,353 feet MSL, Jefferson County, Washington, 20 July 1969; 2, 0.3 mile downgrade from the second station listed above, 4,620 feet MSL, Mt. Angeles Quadrangle, Jefferson County, Washington, 14 July 1969; 1, North Point Lookout, Mt. Walker, 2,586 feet MSL, Mason County, Washington, 26 June 1969.

Corroborative description and proportional measurements. The mantle color pattern varies from nearly black or blue-black through dark gray in front of the shell (slightly lighter behind it) to bluish-black maculated with yellowish or yellowish densely spotted with blue-black and gray, and is mostly devoid of papillae. Sometimes the apex of the dorsal hump is creamy orange-yellow, but this is probably associated with the reproductive period. The sides of the body below the pouch range from white to yellowish white and immaculate. The sides of the body behind the pouch bear numerous gray to blackish maculations. The rather wide edge of the foot is light gray, and there are 54 to 56 cell-like granules above the pedal groove. The head varies from nearly white to light gray, which allows the intensely black optic tracts to show through the integument. The strongly arcuate jaw is striated to its margin, and bears 18 to 20 striae. The secretory groove, located posterior to the shell, is variable in position: directed directly caudad, slightly to the left, or slightly to the right. The inflated penis does not bear an accessory sac. Total length 28.5 mm (24.0-31.0); width foot/total length = 0.13 (2.5-4.0 mm/24.0-31.0 mm); posterior end visceral pouch to pneumostome/total length = 0.24 (4.5-8.2 mm/24.0-30.6 mm); shell width/shell length = 0.59 (2.5-6.0 mm/5.0-9.0 mm); width pouch/length pouch = 0.56 (5.5-7.5 mm/9.9-16.2 mm); width back behind pouch/height behind pouch = 0.68 (3.3-6.0 mm/5.0-6.0 mm).

Comments on natural history. The oval, semi-opaque eggs, 50 to 60 of which are deposited in wet to moist decaying wood, average 3.3 mm (3.0-3.5) in length and 2.5 mm (2.7-2.7) in diameter. At rest, this slug is coiled counterclockwise so that the tip of the tail touches the head. From this position, the animal is capable of quickly recoiling, even to the extent of "jumping" an inch or so, a feature which has been previously recorded in the literature

(Hemphill, in Pilsbry, 1948, and Pilsbry, *Loc. Cit.;* Smith, 1943). This is, to my way of thinking, a very definite anti-predation startle reaction. The histology and musculature of *Hemphillia* needs thorough investigation.

Diagnosis: Hemphillia dromedarius is an arionid slug most closely related to *H. camelus* Pilsbry and Vanatta of Idaho and adjacent Canada but which is distinguished from that species by being darker and more boldly marked (*H. camelus* is mostly ashy-gray with a tendency to produce lateral bands on the visceral pouch, whereas *H. dromedarius* tends toward blue-black), by having a less keeled tail and in possessing a definite caudal horn (Fig. 2) (lacking in *H. camelus*). It differs from *H. danielsi* in matters of coloration and in possessing the inflated penis and in lacking an accessory stimulator

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WINTER DISTRIBUTION OF *MELAMPUS BIDENTATUS* (SAY) ON A CAPE COD SALT MARSH[1]

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Salt marsh snails (*Melampus bidentatus* Say) sometimes comprise much of the food for wintering black ducks (*Anas rubripes*) (Addy,

[1] A portion of the author's Ph.D. dissertation in the Department of Forestry and Wildlife Management, University of Massachusetts.